How Dreams Work

The often surreal nature of dreams seems meaningless. Intense emotions and random elements of reality's rules broken, blur together. But when you understand what dreams are and how they work, every part that seems random has purpose. Every theory on dreams accounts for some aspects but leaves other pieces unanswered. Threat Simulation Theory answers why we're subjected repeatedly to stressful nightmares. Memory Consolidation Theory explains our better performance on activities we've been learning after dreaming of them. All these different, separate theories, however, fit within one framework and one theory. Dreams are simulations of life, created for processing it without our waking mental filters that normally dictate how.

Threat Simulation Theory – You can't problem solve in a nightmare, you're just trapped in its terror. Whether they're an old repeating nightmare, or a new one your mind cooked up, you only ever have two options to respond with. Run away at breakneck speed or fight like your life depends on it. But this is the main point of nightmares according to this theory. Learning doesn't only depend on the abstract thinking through it, but the physical action of repeated practice. By fight or flight we hone our survival reflexes in our nightmares.

Other nightmares don't need a dream response to serve threat recognition. We've all had the classic teeth falling out dream. No matter how exactly the nightmare plays out, we can all remember the helpness of the situation. Our teeth are out and gone one way or another. This fear from the nightmare carries over into waking hours and helps our awareness of the threat. We'll likely floss and brush our teeth more thoroughly than usual that morning.

Physical symptoms like a toothache often bring on these illness nightmares, directing their occurence. Our ancestors

might have benefitted from them, by choosing different diet choices. If one had an infected tooth back then, avoiding wild honey (excess sugar) and tougher to chew foods would have protected recovery.

Some proponents of this theory argue the bizarre elements of nightmares help to manage their fear. This argument doesn't hold up. Our brain can't distinguish nonsensical and irrelevant, from realistic and worrying while in the nightmare. Say we have a nightmare of an army of rubber ducks chasing us down. It may leave us confused and amused upon waking up in the morning. But if we wake up from that same nightmare in the middle of the night, we can feel our heart racing and in a cold sweat even as we start laughing. We were actually feeling terrified in the nightmare.

Why can't our mind use our common sense in the nightmare? Because our logic filters are not active as we dream. Picture yourself grinding out an work assignment on the computer, just to hear a loud bang go off in the neighborhood. For a second or two you can't form a thought, you just jump and gasp in your seat. You can then quickly remember that it's early July and realize people are just practicing setting off their fireworks. Our acquired knowledge and reason gives context to the situation and so manages our fear of it. But in a nightmare your mind doesn't have this access. There is nothing to filter the problem through, so the fear only stays disorienting instead. But fear management isn't the main evolutionary goal of nightmares, survival training is. But since survival isn't always dependent on high stakes training, dreaming also helps us learn new skills.

Memory Consolidation – When we're learning something new, we notice how progress can jump after a strange dream of the activity. The difference between our time on it and the weird dream however, can make us wonder what our brain is doing. Dreams consolidate learning from activities by focusing on the most important patterns of them.

One example of this was in a study of volunteers playing a maze video game. Instead of an accurate replay of the game on a screen, their dreams took the maze and put it in a first person scenario. From a traditional hedges and bushes maze, to a partially water submerged maze, their dreams freely played around with the ideas. Putting the maze into a more personal perspective isn't just our brain having fun, but a more efficient method for learning. We have an easier time noticing something in our 3d space and eye level, than what's on a smaller screen. Our brain isn't afraid to bend its physics if it's more efficient for learning. Is it also willing to bend its understanding of relationships?

Social Simulation Theory – Our dreams often have more of a social life than we do. Proponents of this theory therefore argue dreams are for rehearsing and freely experimenting for our waking life relationships. Rehearsing explains our fairly normal, almost boring dreams of friends and family. Memory consolidation applies here for these rehearsals.

It gets more interesting though, when our brain decides it's time to experiment. That's when we find ourselves yelling our heads off or saying what we want with no filter. If you're thinking of real life's implications for our dream selves actions, it seems our brain is actually being unhelpful. But behind the obvious nuttiness of the dream, is more subtle work our brain is doing with it.

A dream like this can be us screaming it out with our annoying boss. Instead of holding back any workplace unfriendly words, we throw every curse word at him. What your mind is doing with this dream is desentizing you to the extreme end of your possible behavior. Our mind isnt most afraid of what crosses the line, but what runs straight past it. So if you're afraid of standing up to your boss, your mind remedies that by changing your emotional baseline by force. Without needing to worry about real consequences, your brain empowers you to help yourself. Some would argue your brain

also comforts yourself, by fulfilling your wishes.

Wish Fulfillment Theory – A more philosophical argument for dreams is that they reveal to us what we refuse to uncover. From hidden and forbidden desires to grief we've never come to terms with, dreams can fulfill what's missing. Except that the brain's priorities aren't an escape from life, but always solutions to them.

Dreams are a solution to repressed emotions living as unarticulated emotional tension in a person. For example, a stressed honors student is under near constant pressure they would likely rationalize away. By saying to themselves it doesn't matter, they just need to push through, they turn the specific emotional concerns of the overwhelming classes and tests into vague academic anxiety.

Like Freud argued, dreams rely on symbolism and your mind's lack of conscious prioritization. They place your emotions into a manageable category it can access or set aside as needed. The stressed honors student's dream may be of himself on a stage in front of the whole school, reading from a script that won't stop changing. The changing script symbolizes a struggle to keep up with expectations. The stage and audience represent the feeling of their life situation on display. Now the academic anxiety is translated into a clear concrete representation. And so it can be emotionally better categorized and processed. Your mind isn't satisfied with vague explanations for your problems, so it makes a story to process the strain. Emotional strain isn't the only kind your brain needs to process however.

Predictive Processing Theory – If Memory Consolidation Theory explains how our brain uses dreams to help us learn activities, Predictive Processing Theory explains how our brain uses dreams to learn how the world works. Our brain's consciousness is constantly trying to refine our expectations of life's mechanics. It does so by a hierarchy of predictions

and feedback.

Currently held predictions state expectations for how something in the world works. Sensory input such as light, sound and pressure from touch tests those expectations, and updates or reinforces those expectations in a continuous feedback loop. A prediction to waking up to incoming light, is that it's morning. The light being a lamp turned on by someone, or a light switch flicked on tests that prediction. The clock saying 3:00 AM updates the strength of the prediction. So it isn't necessarily activated next time, because it's outweighed by the one of your roommates coming in to look for their laptop.

But how is predictive processing present in dreaming? It is present not by testing them out but by consolidating them. Remembered predictions are combined from multiple memories, and generalized in dreams. A dream of our childhood home usually wouldn't be the exact right childhood home we know. Different elements like the salt lamp from our friend's house, the dark purple blankets and sheets from grandma's house, and toys from our childhood house can all be present in the dream home. The united theme is what home felt like to us as a kid. Multiple predictions of what home means to us are combined. So multiple parts of what our heart recognizes as home, is processed into a whole. But how does our brain pull all of these functions of dreaming off? By reworking its mental state of perception.

How are our waking mental filters not present while dreaming? The answer is in altered states of consciousness. Consciousness as a human whole exists along a broad spectrum. Specific aspects of it are turned up when dreaming, while others are turned off. This doesn't translate into different brain areas being literally switched off or on, but where energy is focused and prioritized. Certain areas relied on for dreaming are highly active while others are not.

When awake these are the areas that make our waking life feel real

- The dorsolateral prefrontal cortex – is what gives us our logic filters. Everyday tasks from cooking a meal, to finishing a work assignment, has us constantly reliant on our reason to determine our decisions. This brain accomplishes it by three tools it keeps on hand; working memory, behavior regulation and critical thinking.

- Working memory – keeps track of the context our brain needs in the moment. Chopping up an onion has us using it by keeping track of the why and what of the onion. Both that we got the onion out for dinner, and that we need to chop it up. Our working memory can lag, causing to stare at the onion on the chopping board and blank for a second. But it kicks back in after a few seconds, enabling us to keep our momentum for the most part.

- Behavior regulation – helps us prioritize what actions we want to carry out, and inhibit unhelpful impulses. Anyone who's done a job that needed a laptop knows the impulse to throw the frozen thing across the room. Our behavior regulation makes us decide to keep troubleshooting the laptop instead.

- Critical thinking – is our ability to reality check our environment. If we see a coat in our closet start jerking and twitching on its own, our mind alerts it as unusual compared to how clothes normally work. Our reality checking gets activated, makes us slow down and realize it's just our phone vibrating.

- The Posterior Cingulate and Precuneus area keeps track of space and time and their relationship together. This function is so automatic to us that how it works can seem invisible. It’s how we keep consistent perception of our 3d environment. With it we know where things are in space and their size. When it’s working abnormally, we may see a wall change distance or reach for a coffee mug and miss it.

- Hippocampus – is responsible for handling our memory. Contrary to common misconception, it does not store memories or information in itself. Its role can be compared to a librarian of an upper scale library.

A librarian of an upper scale library does not directly put the books away, but speaks with clerks in different sections of the library. The clerks in communication with the librarian organize the books. If you ask the librarian where a book is, she would hand you an index card so you can go find it.

The hippocampus acts as the librarian to communicate with different areas of the brain in the cerebral cortex, to prime it to integrate new information into memories. Then like the clerks, those brain areas store those new memories in themselves. The hippocampus uses it’s physical neural wiring as an index card, to communicate with the cerebral cortex where the memories are stored to retrieve them.

When dreaming these are the areas turned up and off, making dreams surreal

- Dorsolateral Prefrontal Cortex – is inactive while dreaming, so our handy reason is missing in our dreams.

- Working memory – Our working memory doesn’t keep track

of the scene at hand or our actions and intentions. So we teleport from a coffee shop in Paris to our friend's basement without a hint of surprise. Instead we seamlessly switch our thoughts and actions to the new situation, responding without confusion or whiplash.

- Behavior regulation – without it, we have no restraint on impulses anymore. We go off on our boss, have a verbal meltdown, and break things, all without regret.

- Critical thinking – Without our critical thinking, we can't check the simulated reality of dreams. Because there's nothing to test the dream against, we readily accept that the sky is now neon green or that our family dog can talk. This allows the dream to be as creative as it wants.

- The Medial Prefrontal Cortex – enables our identity of ourselves. It's how we live in "first person" and relate what happens in our environment and life back to ourselves.

- It is active while dreaming but disconnected from part of its functions. Dreaming disconnects it from our dorsolateral prefrontal cortex and hippocampus. Our hippocampus is what gives us access to the story of our life, or all our memories that make us ourselves. That it's disconnected from the dorsolateral prefrontal cortex means we can't question switching perspectives in the same dream.

We can dream of fighting a dragon and switch perspectives in battle. We may start off in first person when encountering the

dragon asleep, but once the dragon wakes up and rises to strike at us, we zoom out into third person. Then we can continue to fight the dragon but from a distant point of view that isn't as terrifying and overwhelming.

- The Primary Visual Cortex – continuously takes in new raw visual data. This small area is responsible for the collecting of colors, shapes and sizes all fitting together. It's not directly recognizing the meaning of them, that's the job of the area surrounding it.

- The Visual Association Cortex – is responsible for interpreting what we see. It also is where we store our visual memories, and when dreaming our brain relies on them for the simulations it creates. The fact that our dreams seem more vivid than our waking life isn't a coincidence. It's the brain making the most of the resources it has to build the simulation.

- The Amygdala – is responsible for the emotions we feel at full volume in dreams. It can be compared to an associate movie director for the brain. It takes in input from many members of the crew – the different brain areas involved in dreaming – and "directs" the emotional intensity of it. Every crew member pitches in, by the hippocampus's retrieved memories, imagery from the visual association cortex, and the overarching theme from the medial prefrontal cortex. it all gets supervised and emotionally charged by the amygdala.

All these different theories held separately, are argued for as competing claims on the real meaning of dreams. Apart from each other they feel like a cut off answer, partially true but incomplete for the vast range of our dreams. As parts of a united theory of life simulation however, they give more than

a why for our dreams. They explain much of how our brain works. Dreams play a huge part in our brain's maintenance of living, while performing within a small time window of an hour or less. It's a compressed yet finely detailed map of what our mind is doing and why. The more we can read the map, the better we can know where our mind leads us in our lives.

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